words, a two-stage operation—is preferable to an indwelling catheter. The suprapubic tube gives absolute rest to the patient and his urinary tract, does not irritate or infect his bladder, and enables him to move about in bed and sleep in comfort.

Pre-operative drainage is necessary (1) when there is complete retention or more than 4 oz. of residual urine, (2) for renal deficiency, (3) for severe haemorrhage from the prostate, (4) for urinary sepsis and cystitis, and (5) for the patient worn out by nocturnal frequency. It may be necessary for a week only or for several months, during which time the bladder, if infected, is treated by regular lavage, and the patient's immunity raised by an autogenous vaccine.

When the kidneys are defective the duration of drainage depends solely upon the improvement in the clinical condition and the chemical tests. If the deficiency is only due to renal fatigue from back pressure, drainage for a week or ten days will generally suffice, but when it is secondary to organic changes in the kidney drainage may be required for many months. If by nine months the blood urea has not fallen and the urea concentration is still below normal, there is no hope of improvement, and the patient must be content to wear the suprapubic tube for the rest of his life.

We all know that a tired horse will carry a load uphill if given a rest half-way, but if forced he will either jib or drop down dead. The same applies to a kidney tired out by prostatic obstruction: increase the load by a severe operation and it will cease work altogether; but if it be rested by means of suprapubic drainage, prostatectomy will eventually be possible and safe.

There are many surgeons who object to the two-stage operation on the grounds that it necessitates two anaesthetics and two operations, that enucleation is more difficult, and that a subsequent open operation is not possible. The first disadvantage is almost negligible, for the cystostomy can be performed under gas and oxygen with little or no discomfort. Enucleation may be more difficult, but not if the opening in the bladder is made high enough to permit of its enlargement downwards at the second operation. Lastly, an open operation *can* be performed, but requires care in separating the bladder from its adhesion to the abdominal wall.

However optimistic we may be, it is impossible to overlook the many dangers, both local and general, of prostatectomy, and there is no doubt that its gross mortality would be greatly diminished if the two-stage operation were more generally adopted. Only recently I heard of a case of acute retention in which an energetic operator performed an immediate prostatectomy. The patient made an uninterrupted recovery, but it is enthusiasm such as that which helps to make the gross mortality of prostatectomy in the London hospitals round about 20 per cent.[7]—a figure which is far too high.

In conclusion, let me summarize, by three hypothetical cases, the problems I have dealt with.

No. 1.—A man, aged 60, with prostatism, enlargement of the gland, and 2 oz. of clear residual urine. The tongue is moist, the appetite is good, and the complexion is clear. The blood urea is 35 mg. and the urea concentration over 2 per cent. A one-stage prostatectomy can be performed with safety.

No. 2.—A man, aged 68, with pronounced prostatic symptoms and 4 oz. of clear residual urine. The tongue is slightly dry, thirst is increased, and the appetite is not so good as it used to be. The blood urea is 45 to 50 mg. per 100 c.cm., and the urea concentration is 1.9 per cent. This is a clear case of tired kidney requiring rest for a week or ten days before prostatectomy, either by means of an indwelling catheter or a suprapubic tube. My choice would be the latter.

No. 3.—A man, aged 70 or more, with 10 oz. of residual urine, cystitis, and obvious clinical signs of a defective renal function. The blood urea is well over 50 mg. and the urea concentration below 1.7 per cent. A two-stage operation is imperative, with an interval of anything from three weeks to eight months between the first and second stages.

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THE ISOLATION OF B. PARATYPHOSUS B FROM SEWAGE.

BY

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In the past the demonstration of specific pathogenic organisms in sewage and water has proved of the utmost technical difficulty. Methods of selective culture, however, have greatly facilitated the isolation of such bacteria (for example, typhoid-paratyphoid group) from material in which they are greatly outnumbered by other organisms, and these methods have been most successfully applied in the bacteriological examination of faeces from cases of enterica (Browning, Gilmour, and Mackie, 1913; Mackie, 1917; and others). A further development has been the application of selective methods in the examination of sewage and water. Even though the typhoid-paratyphoid bacilli are present in communal sewage containing the excreta of diseased persons or carriers, dilution must render them exceedingly scanty in proportion to other bacteria, and it might be expected that the greatest difficulty would be experienced in demonstrating them even by selective methods. The same would apply to water. The success obtained by Wilson (1928) in demonstrating *B. typhosus* in Belfast sewage by his method of selective culture marks a great advance in this branch of bacteriological investigation. I have applied Wilson's technique along with other methods in the examination of sewage in Edinburgh, and the object of this communication is to record the results of the investigation, which seem of considerable interest and importance from the point of view of public hygiene.

Methods.

The following cultural methods were employed.

1. The "*glucose-bismuth-sulphite-iron-brilliant-green medium*" introduced by Wilson and Blair (1928) and termed by them medium B. The rationale of the use of this medium is explained by Wilson as follows. In the presence of a certain excess of sodium sulphite, bismuth sulphite tends to suppress the growth of most coliform bacilli; when, in addition, a fermentable carbohydrate is present, *B. typhosus* reduces the sulphite to a sulphide, the latter reacting with the iron salt to form iron sulphide, which blackens the colonies. The brilliant green enhances the selective action of the medium for organisms of the enterica group.

With a view to obtaining definite knowledge of the colony appearances of various organisms on this medium, strains of *B. typhosus*, *B. paratyphosus* A, *B. paratyphosus* B, a typical *B. coli*, *B. proteus* and *B. fluorescens* types were plated out. The growths obtained varied very considerably in appearance with the strain of organism and the period of incubation.

B. typhosus produced, after twenty-four hours' incubation, minute clear discrete colonies which after a further twenty-four hours became jet black, or, more commonly, a bright green colour.

B. paratyphosus A was similar to *B. typhosus* except that none of the colonies were black.

B. paratyphosus B. After twenty-four hours' incubation all the laboratory strains of this organism produced clear discrete colonies each 1 mm. in width. After forty-eight hours' incubation these colonies became bright green. In addition, however, one of the strains produced black colonies with a metallic lustre, which after four days' incubation were 6 mm. in diameter and had a raised greyish centre.

B. coli produced, after twenty-four hours, colonies similar to those of *B. typhosus*. After further incubation most of these became bright green; some which grew slowly assumed a black colour, but without metallic lustre.

Some strains of *B. proteus* were inhibited for twenty-four or forty-eight hours, but later produced green colonies varying slightly in shade.

B. fluorescens was also inhibited for twenty-four or forty-eight hours, but later produced dull green colonies, which eventually became brown.

When this medium was inoculated with actual samples of sewage it was found that it inhibited the growth of a very large number of the coliform organisms present. The colony appearances of any one organism, however, varied; thus, "enterica" group may be present in a given sample of sewage and yet may not necessarily produce colonies with a specially distinctive appearance.

Contrary to Wilson's findings, I found that lactose-fermenting organisms might produce black colonies on the B medium. For this reason subinoculation of such black colonies on Wilson's modification of the Endo medium, in which saccharose replaces the lactose, was deemed less suitable than on one in which saccharose was present in addition to the lactose. The presence of the second sugar does not appear to influence any action an organism may have on the other substance. MacConkey's medium containing both sugars was found to give sharper demarcation between pale and pink colonies than the corresponding Endo

medium. Any black colony on medium B which, on subculture, produced a pink growth after twenty-four hours' incubation on the double-sugar MacConkey medium was discarded. Owing to the fact that *B. proteus* and *B. fluorescens* produced pale growths, representative pale colonies on the double-sugar medium were first subinoculated on slopes of Loeffler's inspissated serum. Two days later, if the serum was unliquefied, the morphology and cultural, fermentative and biochemical reactions of the colony were examined.

2. *The brilliant green enrichment method introduced by Browning, Gilmour, and Mackie (1913).* A series of tubes of peptone water containing varying amounts of brilliant green were inoculated and incubated for twelve hours; subinoculation from each tube on a MacConkey plate was then made. The variability in the optimum concentration of brilliant green for the selective enrichment of the enterica group necessitated the use of varying amounts of the dye. The actual amounts of brilliant green used for 5 c.cm. of peptone water were: (1) 0.2 c.cm., (2) 0.3 c.cm., (3) 0.4 c.cm., (4) 0.5 c.cm., (5) 0.6 c.cm., (6) 0.7 c.cm. of a freshly prepared 1 in 10,000 solution, and it was found that the best results were obtained from the tubes containing 0.4 c.cm. and 0.5 c.cm. of the dye.

3. *Rakieten and Rettger's modification of the original brilliant green method.* In this method, prior to the addition of the brilliant green 0.4 c.cm. of a phosphate buffer solution was added to each tube and the reaction adjusted to a *p*H 6.5. The buffer is added to prevent alkalinization of the medium during growth, with the consequent precipitation of the dye.

4. *MacConkey's medium.* In addition, the samples of sewage were plated directly on MacConkey's medium. It was found impossible to isolate paratyphoid bacilli in this way owing to overgrowth by lactose-fermenting organisms.

5. *Wilson and Blair's lactose-bile-salt-brilliant-green medium* (for the isolation of *B. paratyphosus* B) was not found sufficiently inhibitory to coliform organisms, and did not yield sufficiently characteristic colonies in the case of the enteric group. It was therefore not used for sewage.

Examination of the Sewage.

Six samples of sewage were taken in sterilized bottles first from main sewers of four different districts of the city, which may be named A, B, C, and D for reference purposes.

Each of the *selective* methods elicited the presence of *B. paratyphosus* B in the sewage from District A on two of the three occasions on which it was examined. In agglutination and agglutinin-absorption tests each of the strains of the organism corresponded exactly with *B. paratyphosus* B (Schottmüller), controls being performed in which *B. paratyphosus* B serum was treated with emulsions of the homologous organism and *B. aertrycke* and its agglutinating properties then tested with these organisms.

A considerable number of the black colonies on the B medium had to be subcultured and examined further to enable the paratyphoid bacilli to be picked out. This was probably due to the fact that, according to Wilson and Blair (1928), *B. paratyphosus* B behaved on bismuth sulphite media more like a reducing *B. coli* than *B. typhosus*, with the result that the plates had to be incubated for more than twenty-four hours before colonies of *B. paratyphosus* underwent blackening. Organisms other than those of the enteric group therefore had time in which to develop a black coloration.

Since the main sewer of District A contained *B. paratyphosus* B the contents of each of the various tributary sewers entering it were next examined on two occasions. These tributary sewers were numbered from 1 to 7, starting with the most outlying one and ending with the side sewer entering the main sewer nearest to the latter's termination. It was found that of these seven tributaries three contained *B. paratyphosus* B, the identity of the organism being established as before by serological tests. Sewers Nos. 4 and 7 were positive on both examinations, but No. 5 on the second examination only. Thus, in all, *B. paratyphosus* B has been isolated by selective methods from seven out of the twenty samples examined.

The numbers of black colonies on medium B from the same amounts of different samples varied greatly even when the samples had been obtained at approximately the same hour of the same day and therefore could not have been unequally affected by rainfall. For instance, in the first sample obtained from No. 4 there were 209 black colonies on the B plates inoculated with 2.5 c.cm. of the sewage, while a similar amount of the sample from No. 2 obtained at approximately the same hour of the same day showed only 36 black colonies. It may be noted here, too, that the sample from No. 4 was peculiarly rich in *B. paratyphosus* B, for these 209 colonies were all identical in appearance with eleven colonies examined, ten of which were finally identified as *B. paratyphosus* B. The unevenness in the distribution of the organisms producing black colonies on the bismuth sulphite media in one sample rendered useless any attempt at making a quantitative estimation as to the minimal amount of sewage from which *B. paratyphosus* B could be isolated.

Survival of B. paratyphosus B in Sewage.

Experiments were also performed with a view to determining the period of survival of *B. paratyphosus* B in the sewage. All the samples from the main sewers were examined one, two, and four days subsequent to their withdrawal from the sewer in a manner identical with that in which they were examined on arrival at the laboratory as above described. In no instance was *B. paratyphosus* B isolated, so that the evidence pointed to a short period of survival of the organism in sewage.

Comparison of the Selective Methods Employed.

It is difficult at the present time to draw a definite comparison between the selective methods employed. The results obtained by their use varied considerably. In some cases positive results were obtained by each method, but it was found that any one of the three selective methods might fail to reveal the presence of the paratyphoid bacilli, while at least one of the other methods gave positive results.

The plates of Wilson's medium when inoculated with the last four samples taken from the side sewers remained completely sterile. As far as could be ascertained the medium for this batch of plates was prepared in a manner identical with that adopted for the making of the previous samples of media. In the earlier tests the B medium had revealed the presence of *B. paratyphosus* B in every sample of sewage in which the organism had been found by the brilliant green enrichment methods. Wilson and Blair assert that "the bismuth sulphite media enormously increase the chances of isolating typhoid bacilli," and the same undoubtedly holds good for the paratyphoid bacilli.

The brilliant green enrichment methods, although usually effective, were found on occasion to give negative results, when the B medium revealed paratyphoid colonies. In the first sample taken from tributary sewer 4, plates of B medium inoculated with 2.5 c.cm. of the sewage yielded 220 suspicious colonies, ten of the eleven examined proving to be *B. paratyphosus* B; neither of the enrichment methods showed the presence of the organism at all. This was to a large extent due to overgrowth by *B. fluorescens* and *B. proteus* types. Many of the pale colonies, too, were found on identification to be types of Morgan's bacillus. After considerable experimentation it was considered that Rakieten and Rettger's modification did not produce results better than the original method, and in the first sample from side sewer 7 it proved negative while the original method gave a positive result.

Loss of Motility of B. paratyphosus B.

An interesting feature elicited was the loss of motility of certain of the laboratory stock strains of *B. paratyphosus* B, as well as of some of those isolated from the sewage, when grown on medium B. Their motility, however, returned on subinoculation into ordinary nutrient media. Loss of motility of *B. typhosus* in the presence of brilliant green was also observed by Rakieten and Rettger.

Discussion of the Findings.

The results are of special interest as they confirm (for another city in the British Isles) Wilson's finding of an enteric group organism in communal sewage.

So far samples from only four out of the twenty-three districts of the city have been examined, and all those found to contain the paratyphoid bacilli had been taken from sewers in one and the same district. At an early stage of the work enteric organisms were isolated from the main sewer of this district, and all sixteen samples of the second series were obtained from the same district, with

a view to ascertaining whether the organisms were limited to sewage from a localized area. The work was then discontinued owing to the onset of extremely cold and wet weather. The question of the distribution of enteric organisms in the other districts of the city therefore remains to be determined.

Since the city of Edinburgh is at present comparatively free from enteric fever, the presence of *B. paratyphosus* B in the sewage of a particular district is in all probability mainly due to resident "carriers;" and it is significant that this district was the locus of an outbreak of paratyphoid B fever in 1927. The medical officer of health of Edinburgh, in his report for that year, has made special reference to sewage as a source of this outbreak. Owing to the inability of the main sewer of the district to carry off the excessive volume of water during a flood, two of the byre steadings concerned in the outbreak were inundated with overflow from drains and sewers near-by. It seems not unlikely that the milk may have become infected through contamination of the premises in this way. Of course, for the infection to have been thus transmitted the sewage dammed back into the byres must not only have contained the specific organism at the time in question, but must also have been fairly heavily contaminated in view of the dilution with the flood water. The presence of a "carrier" actually at or near the byres would, of course, increase the probability of this happening, but it must not be forgotten that such a "carrier" may have introduced the infection by more direct contamination of the milk vessels.

The suggestion is put forward that, by ascertaining the points of entry of the *B. paratyphosus* B into the various tributaries of the main sewers found to contain paratyphoid bacilli, "carriers" of the organism might be located with the help of public health officials. Criticism may be raised that the strains of *B. paratyphosus* B (Schottmüller) isolated might be of animal origin, for Jordan (1923) has recorded strains of porcine origin belonging to the Schottmüller type. In District A of the city, from which the sewage in question was obtained, there are a number of piggeries, but the rarity of strains of porcine origin and the small proportion of excretal matter from such piggeries in the communal sewage would render unlikely the possibility of these strains coming from such a source. The excreta from several of the piggeries in the district have been examined by the same methods as those which were applied to the samples of sewage, but no paratyphoid bacilli have thus far been isolated. The question, however, is still receiving attention.

SUMMARY.

1. *B. paratyphosus* B (Schottmüller) has been isolated by selective methods from 7 out of 20 specimens of sewage from the city of Edinburgh. Seventeen of the samples, including all the positive ones, were from one district, and were selected in view of the preliminary finding of the organisms in the main sewer of the district.

2. Comparison has been made of three selective methods: (1) Wilson and Blair's "glucose-bismuth-sulphite-iron-brilliant-green medium"; (2) Browning, Gilmour, and Mackie's brilliant green enrichment medium; and (3) Rakieten and Rettger's modification of the second. Any one of the three methods may fail to detect paratyphoid bacilli isolated by the others. Wilson and Blair's method has the advantage that it is a direct plating method, and the enrichment methods have the disadvantage that they tend to permit overgrowth of *B. fluorescens* and *B. proteus* types, which are prevalent in sewage.

3. The organisms are probably very unevenly distributed in the sewage.

4. No evidence has been obtained that paratyphoid bacilli survive for long periods in sewage.

5. The danger of the presence of *B. paratyphosus* B in sewage is discussed, particularly in relation to an outbreak subsequent to the flooding of two byres in 1927, and it is suggested that this method could be adopted in the tracing of "carriers."

6. The possibility of the strains of *B. paratyphosus* B isolated being of animal origin is considered unlikely.

I desire to express my thanks to Professor T. J. Mackie for his advice and guidance in the course of this investigation, and to the burgh engineer and his staff for their willingness in providing samples of sewage.

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TORSION AND STRANGULATION OF A HYDATID OF MORGAGNI.

BY

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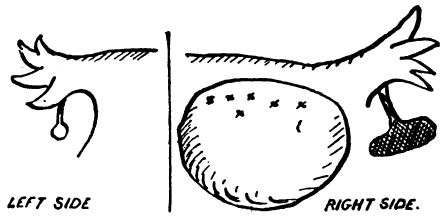
I RECENTLY removed a strangulated and thrombosed hydatid of Morgagni which was giving rise to symptoms resembling those of mild appendicitis. Such a lesion must be very uncommon, and the following details would therefore seem to be of general interest.

A woman, aged 33, who complained of right-sided abdominal pain, was seen by me on August 6th, 1928. She stated that during the previous three weeks she had had several attacks of pain in the right iliac fossa. This pain was colicky in character, and had become so much worse during the last three days before she came to hospital as to provoke vomiting on several occasions.

Her menstrual history was as follows. The last regular period was on May 8th; two months' amenorrhoea followed, after which she experienced irregular losses containing clots, but no obvious products of conception. She had had three pregnancies, all of which resulted in healthy children at full term. In 1921 she had an attack of pain in the right lower abdomen, which was diagnosed as appendicitis, but cleared up without operative intervention. She had never had any similar pain until the present time.

On abdominal examination pain and tenderness were found low down in the right iliac fossa above the lateral third of Poupart's ligament, and slight rigidity over the lower right rectus muscle; no other abnormality was noted. The temperature and pulse were both slightly raised—99.4° F. and 80.

A vaginal examination revealed that the cervix was soft; the external os admitted the finger-tip; the body of the uterus was normally anteverted and anteflexed, and was enlarged to the size of a nine weeks' pregnancy. On the left side there was palpable an ovarian cyst, about two inches in diameter; on the right side the adnexa were not easily palpable, and rather immobile. A diagnosis was made of incomplete abortion, possibly due to right-sided oöphoritis secondary to inflammation of a pelvic appendix.



On August 20th, under spinal anaesthesia, I confirmed these findings by a further bimanual examination, and explored the uterine cavity, from which were removed several necrotic fragments of placental tissue. Pelvic laparotomy was then performed in order to investigate the condition of the appendix and the adnexa on the right side. The appendix was long and showed some slight thickening, but was not markedly abnormal; there was an ovarian cyst on either side, and hanging from the fimbriated extremity of the right tube was a reniform body, black in colour, and measuring about 3/4 by 1/4 by 1/4 inch, in the position in which one would expect to find the hydatid of Morgagni. It showed two well-marked twists in its pedicle, and was much larger than the normal hydatid on the left side. The peritoneum covering it was thick and lustreless. This body was removed without salpingectomy, and appendicectomy was performed.

The appendix, examined subsequently, showed signs of some chronic but no recent inflammation. The reniform body, on pathological examination, was pronounced to be a strangulated hydatid